

Pre-processing and post processing capabilities are strength of any FEA software:

Q-3 (b) (i) Why pre-processing and post processing capabilities are strength of any FEA software? (ii) Describe the analytical capabilities and range of application of ANSYS. {GTU Exam. Dec. - 2011, 07 Marks}-Civil-SE.

A practical problem to be solved by finite element analysis needs hundreds of elements and nodal degree of freedom may exceed over 1000. Hence the preparation of data, such as numbering nodes, generating nodal coordinates, supplying nodal connectivity, load and material information, specifying boundary conditions, is too lengthy process. It needs considerable efforts and is laborious. If handled manually by looking at INPUT statements, possibilities of errors creeping in are discouraging factors. Hence many softwares have been developed to handle the data graphically and display it for the verification. Such softwares developed exclusively to assist in generating finite element analysis INPUT are known as **Pre Processors** of FEA packages. They use Graphic User Interfaces (GUI) for the following:

1. Generate finite element mesh.
2. Number the elements automatically.
3. Number the nodes automatically so as to keep band width least.
4. Generate nodal coordinates, using the values supplied at salient points.
5. Develop nodal connectivity details.
6. Display the standard tables to specify various loads and load informations.
7. Display the tables to specify material numbers and material properties, boundary conditions and other details.

The provisions are made to select only part of the structure to check the INPUT data and alter if necessary. HELP commands are available for the users. PRINT commands are also available to print out data for documentation.

Display III / IV, FEMAP and PATRON are some of the commercially available preprocessor. Upgraded visions are coming up regularly to make preprocessor as user friendly as possible. The preprocessors develop data file required by main FEA program, which is known as Processors. The processors use the data file, analyses and stores the final results.

The output of a FEA consists of nodal displacements, the calculated values of stresses, strains, moments etc. in each element at all Gauss points. The output values calculated are in all global coordinated directions and also in principal directions. It is time consuming to go through entire output file before picking up the required one. Hence the user friendly, Graphic users Interface software have been developed which may be named as **Post Processors**. Normally pre and post processors are clubbed and commercial packages are developed.

With the help of post processor, making use of various windows users can:

1. Pick up absolute maximum stress resultants
2. Plot the graph of stresses along a selected cross section
3. Plot stress resultant or strain contours.
4. Pick up values for specified element or point.

There is competition among software developers to make pre and post processors as users friendly as possible.

The analytical capabilities and range of application of ANSYS:

The following are the capabilities and range of application of ANSYS software:

1. The package supported by an excellent pre and post processor.
2. The element library incorporate all types of elements like 1D, 2D, 3D elements, plate elements, shell elements.
3. The package have a capability to handle different types of loads like concentrated, uniformly distributed, uniformly varying, internal and external pressures, centrifugal forces, moving loads, temperatures stresses.
4. It is possible to impose boundary conditions of all types the user may encounter in his problems.
5. The limitation on degrees of freedom that can be handled on a specified hardware should be as high as possible. This is possible if the processor makes use of banded nature and symmetry in stiffness matrix. Another point where processor can be made efficient is by avoiding repeated calculations of strains ($\oint BdV$) and stresses ($\oint DBdV$) which are assembled while assembling the stiffness matrix. In efficient program these values are written on hard disc element by element while assembling stiffness matrix and read while assembling strains and stresses.
6. The package includes various features like dynamic analysis, buckling analysis and nonlinear analysis.
7. Design is also incorporated in the package, there is a choice for the user to select required codal provisions like Indian standard practice, British codes, American codes etc.
8. An excellent optimizer is available in the package.
9. The package is economical and there is a choice for user to pick up the package to suit his requirement and budget.
10. For large users multi users network version licenses is available.